the Malay Archipelago. This network of rainfall observation now includes 150 stations scattered over the islands at heights varying from near sea-level up to 6404 feet. The averages of the three years show that the mean annual rainfall over the archipelago varies from about 60 inches in Timor to upwards of 200 inches at some spots among the western slopes of Sumatra. But the determining character of the rainfall, as regards the climates is not the absolute amount that falls annually but rather the manner of its distribution through the months of the year. Over the larger proportion of the islands rain falls copiously every month of the year; but as regards some of the islands, the year is divided into dry and wet seasons as markedly as is seen in the climates of India.

The reason of this difference is readily seen on examining the distribution of atmospheric pressure during the months from Australia to China with the prevailing winds resulting therefrom. During the winter months pressure is high in China and low in the interior of Australia, the mean difference being nearly three-quarters of an inch. Between the two regions the fall is practically uninterrupted, and the Malay Archipelago lying between them is swept by northerly winds. Since these winds have traversed no inconsiderable breadth of ocean, they deposit a copious rainfall particularly on the northern slopes of the higher islands, and consequently the rainfall of these months is large over all the islands without exception, the mean monthly amount in some places exceeding 30 inches. It is to these same winds that the north of Australia owes its rainfall; and it is their strength in any particular year which determines the distance to which the annual rains penetrate southwards into the interior of that continent.

On the other hand, during the summer of the northern hemisphere, atmospheric pressure is high in the interior of Australia, and low in China, the mean difference being aboot half an inch, and between the two regions the fall in the mean pressure is continuous and uninterrupted, and consequently southerly winds prevail over the intervening region. These winds are dry and absolutely rainless over the north of Australia, and over Timor and the other Malay islands, which are separated from Australia but by a comparatively narrow belt of sea. During the three years no rain whatever fell at Timor during July and August, and the fall was small during June, September, and October. As the winds pursue their course to northward, they eagerly lick up moisture from the sea, so that by the time they arrive at Amboyna they have become so saturated with moisture that the monthly rainfall of that place rises at this time of the year to nearly 30 inches. At some distance to the west of Timor rain falls at this season more or less regularly every year, the amount increasing in proportion to the extent of ocean traversed by the south-east winds, which blow towards the islands from the direction of Australia. These marked and vital differences of the climates of the Malay Archipelago, which, as they depend essentially on the geographical distribution of the land and sea of this part of the globe may be regarded as permanent, have played no inconspicuous part in the remarkable distribution of animal and vegetable life which characterises the archipelago.

THE COMET

THE receipt of observations from Australia, made between September 8 and 16, has allowed of the determination of the orbit of the present comet exclusively from positions obtained before the perihelion passage when it made so close an approach to the sun. From a mean of the Melbourne and Windsor N.S.W. observations on September 9, and the Melbourne meridian observations on September 14 and 16, Mr. Hind has deduced the following orbit:—

Perihelion passage, Greenwich M.T., Sept. 17·21897

	°	′	″
Longitude of perihelion	275	50	20
Ascending node	345	53	2
Inclination	38	0	17
Log. perihelion dist.	7·8501274		

Retrograde.

The longitudes are reckoned from the apparent equinox of September 17, and it should be mentioned that the small corrections have been neglected. On comparing the observed places with those calculated from the elements founded upon observations before perihelion, the following differences remain:—

			$\Delta\alpha.\cos\delta\,(c-o)$	$\Delta\delta$
			″	″
Tebbutt	Sept.	8	− 25	− 3
Tebbutt and Melbourne	,,	9	0	0
Melbne. merid.	,,	14	+ 21	+ 7
,,	,,	15	+ 5	+ 5
,,	,,	16	+ 1	0
A. Common ...	,,	17	+ 12	− 4

When however we compare with the meridian observations at Dunecht and Coimbra on September 18, or the day after the comet's close approach to the sun, the computed place is found to differ by several minutes of arc from that observed, and at the time when Mr. Gill noted the comet's ingress upon the sun's disc, calculation places it 2′ 30″ within his limb. These differences appear to point to sensible perturbation about the perihelion passage, but a stricter discussion of observations before and after the time when the comet attained that position in its orbit, will be needed before any reliable judgment on this important question can be formed. It may be noted also that a very small change in the time of perihelion passage has a comparatively large effect upon the geocentric positions about that epoch.

Mr. W. F. Denning communicates the following estimates of the length of the tail of this comet made by him at Ashley-down, Bristol; the dates are astronomical:—

Oct. 1	... 10	Oct. 30	... 22	Nov. 8	... 23
,, 11	... 15	Nov. 5	... 23	,, 9	... 22
,, 25	... 19	,, 6	... 23		

To form an idea of the real extent of the tail, assume it first to be situate in the direction of the radius-vector, as is most frequently the case. At 6 a.m. on November 7, by the orbit last published in NATURE, the distance of the comet's nucleus from the earth (expressed in parts of the earth's mean distance from the sun) was 1·4844, and its distance from the sun was 1·4958, the earth's radius-vector being 0·9005. Hence we find the angle at the comet between lines supposed to be drawn to the earth and sun respectively was 38° 49′, from which it appears that an angular extent of 23° would give a real length, as a prolongation of the radius-vector of rather over 196,000,000 miles. But this must be an outside estimate of the linear distance of the extremity of the tail from the nucleus, as there was sensible curvature of the tail, the effect of which may be readily seen by a graphical process upon the above data.

We subjoin the Melbourne meridian observations, to which reference has been made:—

	Melbourne M.T.				Apparent R.A.				Apparent N.P.D.		
	h.	m.	s.		h.	m.	s.		°	′	″
Sept. 14...	23	10	13·7	...	10	45	53·34	...	89	55	47·1
15...	23	22	36·6	...	11	2	14·89	...	89	29	39·2
16...	23	39	0·3	...	11	22	37·75	...	88	47	55·2

The observation of September 15 was made with great difficulty, the comet being obscured by cloud.

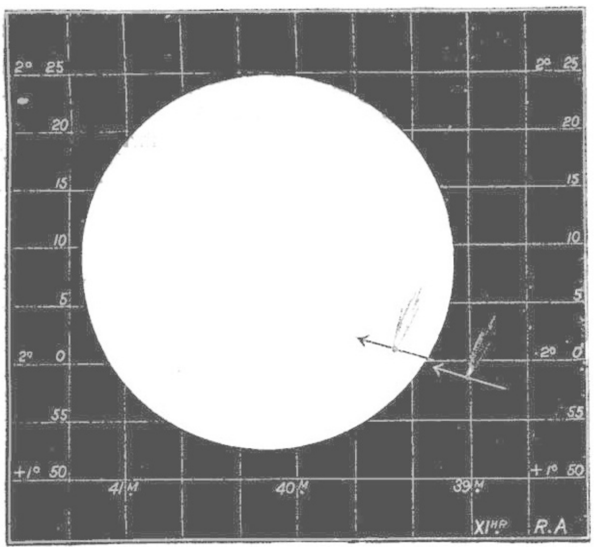
THE following communications speak for themselves :—

Columbia College, New York, November 4

DEAR SIR,—I have received the inclosed communication from Prof. Chandler, of Boston. The letter may interest your readers. J. K. REES

Harvard College Observatory, Cambridge, October 28

DEAR SIR,—Your note of the 26th inst. was duly received. I respond cheerfully to your request, although as I have but a quarter of an hour at my disposal, I trust you will regard my answer as furnishing in a disconnected form the principal points in the results so far reached by me, and will bear in mind that I have not had an opportunity to arrange them in a more formal shape. Of course the most interesting point in connection with this comet, astronomically, is the opportunity afforded to decide the question of the disturbance which a comet will experience in passing through the coronal regions in the close vicinity of the sun. Of all the comets which have passed near enough to be disturbed by this cause, this is the only one which has been observed on both sides of perihelion. Not to mention others, the comets of 1680, 1843, and 1880, all of which present such close resemblance to the present comet, as to have raised in some quarters the question whether they are not, in fact, returns of the same body, were observed, either insufficiently to decide this question of disturbance in the sun's upper atmosphere, or were observed only on one side of perihelion.



Ingress of Gould's Comet upon Sun, September 17, 1882.

In the case of this comet, however, there will be available a very extensive series of accurate observations at the Cape of Good Hope from September 8; almost continuously up to within two hours of perihelion passage, ceasing only with the ingress of the comet upon the sun's disc, the instant of disappearance being accurately observed; an observation unparalleled in astronomical history, and of the greatest value. The comet was also observed at Rio Janeiro on September 11, and probably followed up to perihelion.

I have also received from Dr. Gould a private letter dated September 15, on other astronomical matters, at the end of which he states incidentally that a brilliant comet had been visible there "for more than a week, of which he had two observations, and was awaiting clear weather, in order to observe it in the meridian." Thus in all probability he was the first to descry the comet, as, by a curious coincidence, he was the first to see the one, which so closely resembled it in 1880.

After perihelion of course there exists, and will be accumulated hereafter, an abundant body of data to fix its orbit, after emergence from the coronal regions. Of all the observations before perihelion, we are in possession as yet only of a position on September 8 at the Cape of Good Hope, the time of ingress upon the sun's disc on September 17, and Mr. Common's observations on September 17. The last, Mr. Common's, I have not yet examined; but from the others I have been led to conclude that little if any disturbance could have been caused by resistance experienced in the sun's atmosphere, so to call it, for the sake of convenience.

The grounds of this conclusion are the following:—Taking all the observations available about a week ago, others have come to hand since, and verify the calculation, although they could not be used in it, which were made since perihelion passage, *i.e.* from September 18 to October 20, I first computed an orbit from normal places, assuming the orbit to be a parabola, with the following results:—

1882.

T = Sept. 17·22013 Greenwich M.T.

$$\left.\begin{array}{rl} \pi = & 55^\circ\ 22'\ 26''\cdot8 \\ \omega = & 69\ \ 28\ \ 46\cdot4 \\ \Omega = & 345\ \ 53\ \ 40\cdot4 \\ i = & 141\ \ 55\ \ 15\cdot0 \end{array}\right\}\ 1882\cdot0$$

$$\log. q = 7\cdot8915778$$

The deviation of the middle place ($c-o$) was $+18''\cdot8$ in longitude and $+8''\cdot8$ in latitude. It was very plain that the observations could not be satisfied better than this by any parabolic hypothesis. I accordingly computed an elliptical orbit as follows :—

T = Sept. 17·2304 Greenwich M.T.

$$\left.\begin{array}{rl} \pi = & 55^\circ\ 12'\ 41''\cdot2 \\ \omega = & 69\ \ 22\ \ \ 7\cdot2 \\ \Omega = & 345\ \ 50\ \ 34\cdot0 \\ i = & 141\ \ 54\ \ 56\cdot2 \end{array}\right\}\ 1882\cdot0$$

$$\log. q = 7\cdot8835636$$
$$e = 0\cdot9999700$$

Notwithstanding the nearness to unity of the value of the eccentricity thus obtained, I believe that the ellipticity of the orbit is real, although the corresponding period is very long, something about 4000 years. Whether this is so or not is not of great importance as regards my present purpose. If now we take the observation of September 8, nine days before perihelion, and compare it with the places which are assigned by these orbits, we find that the difference is only $2\frac{1}{2}$ seconds in right ascension and something over 1′ in declination. Thus the differences (Computation—Observation) are for the

	$c-o$ $\Delta\alpha$.		$\Delta\delta$.
Ellipse	$-2^s\cdot5$.	...	$+75''$
Parabola	$+2^s\cdot5$.	...	$+95''$

quantities which are certainly not larger than the uncertainty of the calculation, that is, not greater than we ought to expect even if the comet had been subjected to no chance of disturbance.

Again, if we compute the place which would be assigned by the two orbits for the instant of ingress of the comet upon the sun on September 17, as observed at the Cape of Good Hope, and also the place of the sun, we have their relative positions as shown in the inclosed diagram, where the calculated places of the comet are indicated by the sign ☌ for the ellipse and parabola in red and black respectively, and the arrows indicate the direction and amount of the comet's motion in a quarter of an hour, as calculated by the orbits. It is significant that it would be necessary to assume a correction of only five or six minutes in either time of perihelion passage to bring the comet exactly upon

the sun's limb, where observations indicated it should be. As it cannot be considered that from present data we are certain as to the true time of perihelion passage within this amount, it seems that we have no reason to suppose that there has been any effect of retardation experienced. In fact the deviation shown by the ellipse is opposite to that which would have been the result of such retardation.

It should be remarked (as being of interest) that at the instant of entry upon the sun, the comet was about 1,600,000 miles from its surface (the true anomaly being about 90°).

The perihelion passage took place less than two hours after. The whole half circuit of the sun (from $v = -90°$ to $v = +90°$) occupied but $3\frac{1}{2}$ hours. It is certainly an interesting fact to consider, that an object of such limited dimensions and small gravity can pass at such an enormous velocity for hours through the sun's upper atmosphere, and emerge with so slight an effect on its motion as this body has apparently experienced.

An additional argument in support of my conclusion that little or no disturbance was suffered can be drawn from the fact that the comet, after passing this ordeal, is departing with nearly parabolic velocity, as the slight variation of the eccentricity from unity in the above elements proves.

Another interesting point which I would simply indicate, without discussing, is the bearing of the visibility of the comet clear up to the sun's edge. Prof. Pickering has suggested that the light which rendered it visible in this position must have been nearly all from the comet's own incandescence, scarcely any of it from reflection of the sun's light.

I think that the orbits which I have given may be considered as setting at rest completely the idea of identity of the present comet with those of 1668 and 1843. I say nothing of that of 1880, since there, although the hypothesis of its identity has been entertained in some quarters, it cannot for a moment be regarded as tenable. I have elsewhere shown that the deviations between the observations in 1880 and any hypothesis involving an ellipse of less than ten years' period for that comet, are too large to be considered for an instant as probable. The hypothesis of identity with comet 1880, I., may therefore be left to the sensation-mongers.

I inclose a copy of the *Science Observer Circular*, the regular issue of which will be out in a few days. The figures I have here given differ very slightly from those in the printed circular, but you may regard what I give in this letter as the latest. The elliptical orbit will dispose of the systematic deviations in the table (columns $o - c$) completely, and leave only the unavoidable observation errors.

You may make what use you please of this, except to treat it as a formally-prepared paper.

S. C. CHANDLER, Jun.

INFLUENCE OF "ENVIRONMENT" UPON PLANTS

IN the *Indian Forester* for July, 1882, Dr. Brandis, Director of the India Forest Department, has given the following interesting particulars as to the change in the season of flowering of the Australian acacias introduced in the Nilgiris:—

"*Acacia dealbata* was introduced on the Nilgiris before the year 1845. Col. Dun, the owner of many houses in Ootacamund, had planted several trees in his compounds, probably several years before 1845, but the tree was by no means common, and as late as 1855 was sold at the Government gardens, at two annas a plant. A curious fact regarding the flowering of this tree has been observed:—In 1845, and up to about 1850, the trees flowered in October, which corresponded with the Australian flowering time; but about 1860 they were observed to flower in September; in 1870 they flowered in August; in 1878 in July, and here, this year, 1882, they have begun to flower in June, this being the spring month here, corresponding with October in Australia. All the trees do not flower so early, because at various times seeds have been imported from Australia, and the produce of these would of course flower at the same time as the parent trees in Australia, until acclimatised here.

"Having watched the flowering of these trees for nearly forty years, there cannot be any doubt in the matter; and it is a curious fact that it should have taken the trees nearly forty years to regain their habit of flowering in the spring. Commencing in October, our autumn, it has gradually worked its way back to summer, and finally to spring; probably it will remain at this point."

I have tried to see whether any similar change of season could be traced at Kew.

Acacia dealbata can only be grown under glass with us. It forms a small tree in the Temperate House, and is a splendid object when in full flower. This usually takes place in early spring or towards the end of winter, say about February. Sir Joseph Hooker observed that *A. dealbata* and *A. decurrens*, var. *mollis* (which are closely allied species), flowered at the same time in Tasmania. In Aiton's Hortus Kewensis (1813, *A. decurrens*) is said to have been introduced in 1790 by Sir Joseph Banks, and to flower in May-July. The evidence, then, as far as it goes, would seem to indicate that the flowering time had also progressively worked back in England, though under more artificial conditions.

W. T. THISELTON DYER

THE MAGNETIC STORM AND AURORA

THE telegraphic system of this country has, since Friday morning last, been disturbed in a way that far exceeds anything of the kind that has ever happened before. Very powerful electric currents have been swaying backwards and forwards through the crust of the earth, taking all telegraphic circuits in their progress, and entirely stopping communication. Communication has been maintained only where it was possible to loop together two wires, so as to avoid the use of the earth altogether. The electric storm commenced on Thursday, but it reached its climax on Friday morning (November 17) between 10 and 11 a.m. The currents measured over 50 milliampères, which is five times greater than the ordinary working currents. They have repeated themselves at intervals ever since, but have scarcely attained such an intensity as on Friday morning.

Mr. Preece, whose experience in examining earth currents now extends over a period of thirty years, asserts that this storm was the most terrific he has ever observed. It was characterised on Friday by a rapid succession of alternate waves of great strength.

Both the storm and the aurora seem to have extended to America; the Philadelphia correspondent of the *Times* telegraphs under date November 19:—

"The electrical storm which began to derange the telegraph wires on Friday last still continues, though with less intensity. It spread through Canada and the greater part of the United States, as far west as Utah. The electricians say that the disturbance was unlike any heretofore known, acting upon the wires in strong waves, which produced constant changes in the polarity of the current. A magnificent aurora appeared on Friday night and was visible at all points, except where clouds obscured it. Cold weather, with snow, accompanied the storm in many places."

We have received many letters on the auroral phenomenon of Friday last; as introductory to these we give the following communication from Mr. W. H. M. Christie,